

Antibiotic Use in a Small Community Hospital

FRANCIS D. PIEN, MD, MPH; WILLIAM K. K. LAU, MD, and NAOMI SUR, Honolulu

Audits of medical records were done for similar one-month periods in 1974 and 1977 in a 125-bed community hospital in Hawaii to determine patterns of antibiotic use. One quarter of all hospital patients in both study periods received antibiotics. In 1977 cephalosporins, ampicillin and aminoglycosides were the most commonly used antibiotics. Half of the antibiotics used by surgical specialty departments in both periods were for prophylactic indications. The cost of antimicrobial prophylaxis per patient was reduced by about 57 percent in 1977 compared with 1974. In the 1977 period, 58 percent of patients received proper prophylactic antibiotic regimens; this was statistically higher than the 15 percent of patients given appropriate prophylactic antibiotics in 1974. Fewer than half of the patients in both study periods treated for infections received correct antibiotic therapy. In contrast, 82 percent of infectious disease consultations were considered appropriate by an independent specialist in infectious disease. However, these consultations were obtained in only 15 percent of the patients who received therapeutic antibiotics. It was concluded that audits of patients receiving antibiotics can be effective in the development of appropriate prophylactic surgical regimens. However, during the study period in 1977, we were not able to show large scale improvement in therapeutic antimicrobial use at this community hospital, either by our attempts at physician education or by making infectious disease consultations available.

ANTIBIOTICS are the most commonly prescribed drugs, and approximately 25 percent of all patients admitted to hospital receive antibiotic therapy.¹ Hospital Accreditation Standards on Infection Control established by the Joint Commission on Accreditation of Hospitals now include "the regular review of clinical usage of antibiotics."² A

From the Department of Medicine, University of Hawaii-John A. Burns School of Medicine, Honolulu.

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Reprint requests to: Francis D. Pien, MD, Straub Clinic & Hospital, 888 South King St., Honolulu, HI 96813.

committee of experts from the American Medical Association has made preliminary recommendations that each hospital should monitor antibiotic use, develop guidelines for appropriate use of antibiotics, distribute such guidelines to its medical staff and have a consultant review antibiotic use annually.

In 1979 Scheckler and Bennett conducted surveys in seven community hospitals and reported that in 62 percent of all patients who received antibiotics there was no recorded evidence of in-

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fection.³ In 1972 Roberts and Visconti reported that 87 percent of patients in a single community hospital received either "irrational" or "questionable" therapy.⁴ Since these studies, several evaluations of *appropriate* antibiotic usage have been done in large academic centers, using carefully devised categories of performance.⁵⁻⁷ In 1974 and 1977 we used such criteria to evaluate the use of antibiotics in a community hospital in Hawaii.

Methods

To determine prevailing antibiotic usage patterns, a retrospective audit was done of patients in a 125-bed community hospital who received antibiotic therapy and were discharged during a month in 1974. Information was obtained regarding the type of antibiotic, dosage, duration, cost and reasons for therapy. Prophylactic antibiotic therapy was defined as the use of antimicrobial agents in uninfected patients in the hope of preventing infectious complications often associated with instrumentation or a surgical procedure. These patients had no fever, leukocytosis (greater than 10,000 leukocytes per cu mm) or clinical suspicion of having infected lesions.⁸

Initially, what constituted *appropriate* prophylactic antibiotic use was decided in January 1975 on the basis of a review of medical literature concerning each surgical procedure; these assessments were reviewed again in 1978 using the criteria of the Veterans Administration Ad Hoc Interdisciplinary Advisory Committee on Antimicrobial Drug Use^{8,9} and a study of prophylactic antibiotics in orthopedic surgery by Pavel and co-workers.¹⁰ Use of *therapeutic* antibiotics was classified by categories suggested by Kunin and co-workers:⁵ (I) agree with antimicrobial therapy as appropriate; (II) agree with antimicrobial therapy because a potentially fatal bacterial infection cannot be ruled out; (III) agree with the use of antimicrobial therapy, but a different (usually less expensive or toxic) antimicrobial is preferred; (IV) agree with the use of antimicrobial therapy, but a modified dose is recommended; (V) use of antibiotic therapy is unjustified.

During the latter half of 1975 results of this initial study were given orally and in writing to each hospital department at one of their monthly meetings. Proper antibiotic use in specific cases was discussed and cost of each antibiotic was emphasized. A detailed list of references concerning prophylactic antibiotic usage was prepared for each surgical department and antibiotic guide-

lines for various procedures were determined cooperatively. Several lectures on antibiotic treatment of infectious problems were given to both attending and resident staff physicians. Also, beginning in 1975, infectious disease consultations in the hospital were available anytime by request of attending physicians. There were no drug restrictions or microbial culture requirements.

After three years, another audit was done of medical records of all patients receiving antibiotics who were discharged during a month in 1977. The senior author reviewed retrospectively prophylactic use of antibiotics, using the 1974 criteria. An infectious disease consultant (W.L.), with no cases at this hospital, reviewed all therapeutic use of antibiotics with the criteria previously described. Statistical differences in antibiotic use for the two study periods were determined by chi-square analysis.

Results

General Patterns of Antibiotic Usage

Table 1 shows the comparative prevalence of antibiotic use by hospital services in 1974 and 1977. In 1974 it was found that 24 percent (99

TABLE 1.—Antibiotic Use by Hospital Service

Hospital Service	Percent of Patients Receiving Antibiotics Compared to Total Hospital Patients in Each Service		Percent of Prophylactic Antibiotic Use Compared to Total Antibiotic Use in Each Service	
	1974	1977	1974	1977
Medicine	22	19	20	2
Surgery/gynecology . .	26	33	62	57
All services	24	27	55	41

TABLE 2.—Use of Individual Antibiotics

Antibiotic	Percent of Total Antibiotic Orders		Percent of Prophylactic Use Compared to Total Use	
	1974	1977	1974	1977
Ampicillin	28	21	32	27
Cephalosporins	16	30	50	52
Tetracyclines	12	6	27	17
Urinary antibiotics (sulfonamides, nitrofurantoin) . . .	14	4	50	50
Clindamycin	7	4	33	0
Erythromycin	7	6	83	58
Penicillins (including semisynthetic)	6	7	40	38
Aminoglycosides (gentamicin, tobramycin, kanamycin, neomycin)	9	20	11	23
Chloramphenicol	1	2	0	33

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patients) of all discharged patients received antibiotic therapy. In 1977, however, 27 percent (154 patients) received antibiotic therapy. Total prophylactic use of antibiotics in the month in 1977 was somewhat lower than the period in 1974 (41 percent versus 55 percent); however, this was not statistically significant ($p < .10$). When analyzed by department, it was found that certain surgical specialties (orthopedics, general surgery, cardiovascular surgery, thoracic surgery, urology and plastic surgery) used antibiotics in 40 percent to 50 percent of their patients—twice as frequently as in the medical department. As shown in Table 1, the increase in frequency was primarily the result of a high incidence of surgical prophylaxis.

Table 2 shows a comparison of the antibiotic classes most commonly used in the two study periods. Ampicillin, cephalosporins and tetracycline were among the most common drugs used in 1974. In 1977 a third of the antibiotics ordered were cephalosporins; in half of these instances the drugs were used prophylactically. Only 9 percent of the antibiotics ordered in 1974 were aminoglycosides; this increased to 20 percent in 1977.

TABLE 3.—Cost of Antibiotic Medications to Patients

Hospital Service	Therapeutic Antibiotic Cost* (dollars per patient)		Prophylactic Antibiotic Cost* (dollars per patient)	
	1974	1977	1974	1977
Medicine	47	140	34	16
Surgery/gynecology ..	30	78	53	21
All services	54	96	47	20

*Calculated with December 1974 drug prices

Table 3 indicates the cost to hospital patients of antibiotic therapy during our study periods, based on prevailing prices in December 1974. The cost of prophylactic antibiotics in 1977 was \$20 per patient, less than half the cost in 1974. The cost per patient for therapeutic antibiotics increased from \$54 in 1974 to \$96 in 1977. This increase was seen in all three services of the community hospital.

Appropriateness of Prophylactic Use

Table 4 compares the prophylactic use of antibiotics in 1974 and in 1977. In 1974 only 15 percent of patients were considered to be receiving appropriate prophylactic antibiotic regimens, compared with 58 percent in 1977. This was a statistically significant improvement ($p \leq .001$), primarily seen in cardiovascular, gynecological and general surgical services. There was no statistical differences between patients treated for inappropriate indications and those treated with an improper choice of antibiotic. The major difference was in the antibiotic regimens; only 4 percent of patients in 1977 did not have prophylactic antibiotics started prior to or during their surgical procedure, compared to 32 percent in 1974 ($p \leq .001$). Also, most postoperative treatment periods were shortened to 8 to 72 hours, depending on the nature of the procedure.

Appropriateness of Therapeutic Use of Antibiotics

Table 5 compares therapeutic use of antibiotics in the two study periods. In 1974 it was found that 45 percent of infections were treated appro-

TABLE 4.—Patterns of Prophylactic Antibiotic Use

Hospital Service	Number of Patients Treated Prophylactically		Percent of Patients Receiving Appropriate Prophylactic Antibiotic Therapy		Percent of Patients Treated for Inappropriate Prophylactic Indications or With Improper Antibiotics		Percent of Cases With Only Wrong Timing in Antibiotic Administrations	
	1974	1977	1974	1977	1974	1977	1974	1977
Medicine	7	1	0	100	0	0	0	0
Gynecology	9	2	0	100	13	0	87	0
Cardiovascular surgery ..	2	7	0	100	0	0	100	0
General surgery	4	7	25	56	75	42	0	0
Orthopedic surgery ...	5	15	80	93	20	7	0	0
Urology	5	10	0	20	100	80	0	0
Other surgical sub-specialties (ear, nose, and throat; plastic surgery, thoracic surgery, neurosurgery)	9	13	12	15	55	70	33	15
All services	41	55	15	58	53	38	32	4

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TABLE 5.—Patterns of Therapeutic Antibiotic Use

Hospital Service	Number of Infections Treated for Therapeutic Indications		Percent of Infections in Categories									
			Appropriate				Inappropriate					
			I		II		III		IV		V	
	1974	1977	1974	1977	1974	1977	1974	1977	1974	1977	1974	1977
Medicine	28	51	32	35	11	15	39	29	0	15	18	8
Surgery/gynecology	29	38	48	34	0	8	35	29	10	13	7	16
All services	57	89	40	35	5	11	38	29	5	15	12	11

priately (Kunin's categories I and II, as previously discussed). In 1977, 46 percent of patients with infections received appropriate antibiotic therapy. There were no significant differences in these percentages or in the other categories.

Effectiveness of Infectious Disease Consultation

During 1977 only 11 (15 percent) of the 75 patients who received therapeutic antibiotic therapy had consultations with a specialist in infectious disease. The recommendations made by the consultant resulted in antibiotic regimen changes beneficial to patient care in nine of the 11 (82 percent) cases assessed by an independent specialist in infectious disease. The antibiotic regimens were considered unsatisfactory (categories III and IV) in the remaining two cases. In six of the infectious disease consultations, the patient's initial antibiotic therapy was changed from an *inappropriate* category (III or IV) to an *acceptable* one (I or II).

Discussion

Recently, great emphasis has been placed on correcting the misuse of antibiotics to avoid adverse reactions, reduce bacterial drug resistance, decrease patient cost and possibly reduce the rate of superinfection. Kunin and co-workers⁵ reported that in 1969 a three-month study of antibiotic use at the University of Virginia hospital showed that 27 percent of medical patients and 29 percent of surgical patients received antibiotics. In that study, 58 percent of the surgical patients and 6 percent of the medical patients were given antibiotics for prophylactic indications. In 61 percent of the surgical cases and in 42 percent of the medical cases therapy was considered inappropriate (categories III to V). A similar study at Duke University Medical Center in 1973 indicated that 64 percent of antibiotic use was inappropriate, due primarily to errors in surgical prophylaxis; only 19 percent of therapeutic antibiotics therapy given to medical patients was con-

sidered inappropriate.⁶ Jones and associates⁷ placed 45 percent of all treated patients at the Dallas Veterans Administration Hospital in *inappropriate* or *unjustified* category, even after six months of intensive physician education.

The frequency and distribution of individual antimicrobial usage in our study was similar to that in previously published reports.³⁻⁷ We found in our initial evaluation in 1974 that only 15 percent of prophylactic antibiotics and 45 percent of therapeutic antibiotics were used appropriately. Because our study was done in a private community hospital, we felt that previously described restrictive measures, such as required consultations^{5,11} or formulary control were not practical. Also, as was suggested by Counts, ideally physician education should be the first factor in controlling antibiotic usage.¹²

Our attempts at physician education were well received. Each surgical service welcomed a review of the scientific literature for indications and antimicrobial regimens currently recommended for prophylaxis. Standardized antibiotic regimens were collaboratively designed for various surgical procedures in cardiovascular, orthopedic and gynecological surgery. These measures greatly improved prophylactic antibiotic use in 1977. In addition, because antimicrobial regimens were significantly shortened, the cost of prophylactic antibiotics per patient in 1977 was reduced to less than half the cost in 1974 (Table 3).

In contrast, we found no improvement between the two study periods in the use of therapeutic antimicrobial agents, despite educational lectures and infectious disease consultations. The cost of therapeutic antibiotics increased dramatically in 1977, partially because of more frequent and prolonged use of cephalosporins and aminoglycosides (Table 2). More important, there was no difference in the total percentage of appropriate treatments for infections in the two study periods (45 percent versus 46 percent). Although physicians welcomed information on the proper selection of

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antibiotics, they were not able to apply this information properly to most patients treated for infection. This can be explained by the large number of new antibiotics, the complexities of microbiological diagnosis and the extensive literature concerning treatment of different infectious diseases. In spite of these factors, these physicians used infectious disease consultations rather sparingly: in 15 percent of therapeutic cases in this study. As a result of consultations, the antibiotic regimens of several seriously ill patients were changed from *inappropriate* categories to *appropriate* ones.

The clinical significance of this study is not clear; a much larger audit based on patient outcome would be required. Many of the patients who received therapeutic antibiotic therapy were treated for mild infections. The efficacy of prophylactic regimens of antibiotics is largely undetermined for *clean* cardiac or orthopedic surgical procedures. However, our judgment of proper antibiotic use was based on extensive published experiences with therapeutic and prophylactic antimicrobial use. Therefore, *correct* antibiotic

therapy should ultimately be highly beneficial to all hospital patients receiving antimicrobial drugs.

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Acupuncture as a Placebo

It's THOUGHT PROVOKING to evaluate our competitors and, in the recent past, acupuncture has been something that has been considered a very effective competitor of the physician, at least in some cultures. . . . Would the acupuncturists do almost as well with a lot of our patients as we do? . . . I think it is fair to say, without even tongue in cheek, that 35 percent of the patients that come into your office or mine would be substantially benefitted—a lot of them even would be cured in a month or two—with almost any eye problem. . . . There are a lot of different kinds of placebo therapy. . . . Every action that you take upon a patient has a placebo effect in addition to a specific effect.

—WILLIAM H. HAVENER, MD, Columbus, Ohio

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